FY97 BASIC RESEARCH PROGRAM

Gary R. Wilson
P.O. Box 8029
Applied Research Laboratory
The University of Texas at Austin
Austin, TX 78713-8029
Phone: 512-835-3429 / 512-835-3383 Fax: 512-835-3259
e-mail: wilson@arlut.utexas.edu, efrazer@arlut.utexas.edu
Award #: N00014-96-1-0298

LONG TERM GOALS

The Basic Research Program at ARL:UT emphasizes the Laboratory's commitment to basic 6.1 research, utilizing the expertise of faculty, research staff, and students in collaborative efforts. Publishing in archival journals and focusing new 6.1 research thrusts in arenas of future naval significance is encouraged, as are transitions to possible future funding under other ONR and DoD programs.

FY97 RESEARCH PROJECTS

Dynamic Adaptive Autonomy in Multiagent Systems, Dr. K. Suzanne Barber: This research seeks to prove the following hypothesis: *The operational level of agent autonomy is key to an agent's ability to respond to dynamic situational context, (i.e. the states, events, and goals that exist in a multiagent system), conflicting goals, and constraints on behavior*. The following research issues for the development of Sensible Agent capabilities were investigated: 1) How should declarative and behavioral information about agent states, events, actions and beliefs be represented to support system and local views?; 2) How should dynamic adaptive autonomy be represented in an agent-based architecture?; 3) How should the operational level of autonomy be determined for each agent?; 4) How can problem solvers be effectively incorporated into multiagent systems operating under dynamic adaptive autonomy? and 5) How does adaptive autonomy contribute to the performance of multiagent systems? Results of this effort have appeared in 18 papers in refereed publications including three invited conference papers.

Structural Acoustics of High ka Backwards Waves in the Target Strength of Cylindrical Shells, Dr. Greg Kaduchak: This project has focused on backscattering enhancements associated with guided waves possessing a negative group velocity. Backscattering enhancements due to the existence of such waves have been demonstrated in both calculations and experiments involving anisotropic, layered cylindrical shells. In the process of this study, large scattering enhancements near the coincidence frequency were found to exist over a large range of incidence angles ranging from axial to broadside incidence for isotropic shells. It is the first study to analyze the existence of guided waves beyond the shear wave cut off (approximately 35 degrees off broadside incidence). The results were presented at recent ASA meetings and will appear in the Journal of the Acoustical Society of America and IEEE Oceanic Engineering.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 1997		**00-00-1997 to 00-00-1997**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
FY97 Basic Research Program	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **University of Texas at Austin,Applied Research Laboratories,Austin,TX,78713**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**3**	

Experimental Investigation of Traveling Ionospheric Disturbance Theory, Dr. Tom Gaussiran: This investigation centered on fielding an experiment to measure wave characteristics of traveling ionospheric disturbances (TIDs). To this end ARL:UT deployed three chains of tomography receivers as well collected GPS data from across the eastern half of the continental US. These data were reconstructed into a series of three dimensional maps of electron density. The method turns out to be too slow for measuring TID parameters so we returned to an analysis of raw data. This data showed 'signatures' similar to simulations that we completed.

Concept Development of a Two State Classifier for Vehicular Signatures, Dr. G. Douglas Meegan: This project involves the investigation and development of methods for automated land vehicle detection and classification. Characteristic features (i.e., engine types, weights, etc.) of hundreds of international military and non-military vehicles have been tabulated. From this database, several distinguishing vehicle features have been identified and methods of extracting some of these features from radiated seismic and acoustic signatures have been identified. In particular, algorithms that can determine the number of axles and can identify if a given vehicle is loaded or unloaded have been developed and tested in controlled vehicle experiments.

Modal Analysis and Multi-Mode Seismic Inversion in Layered Elastic Media, Dr. Tom Muir: Many of the modes that are most important in both beach and shallow-water sediment seismic signals are neither classic leaky waves nor properly trapped layer modes. Neither, though, can they be generically classified as lower layer "headwaves", in a way that makes it possible to predict a single, well-defined behavior for them. In this project we have conducted a comprehensive analysis of the evolution of these modes, in a way that can both be employed by inversion algorithms and used to predict their role in seismic signals in realistic, range-dependent environments.

Ultrasonic and Sonochemical Lysogenesis of Bacteria, Dr. Shelley Payne: The effects of three types of ultrasonic radiation on bacteria are being examined: (1) continuous and pulsed cavitating fields at low kHz frequencies, (2) continuous sonoluminescent fields at moderate kHz frequencies, and (3) wideband impulsive shock fields at high kHz frequencies. Bacterial survival is being measured under each condition. For our initial studies, we used two human intestinal bacteria: Escherichia coli and Shigella flexneri. The bacteria were exposed to ultrasonic radiation, and plated on rich medium to determine survival. Cavitation was highly efficient at killing the bacteria, while sonoluminescence and shock fields had little effect. The intensity and time of exposure to cavitating fields were varied. It was found that the number of surviving bacteria could be reduced below detectable levels by sonication. These initial studies were done by a batch process; we are now determining conditions for continuous flow processing. A second sonication step is being introduced to eliminate the approximately 1% carryover of live bacteria. This should result in development of a design for continuous processing to significantly reduce or eliminate microorganisms in wastewater.

HS High School Apprenticeship Program, Dr. Gary Wilson: The purpose of the apprenticeship program is to provide outstanding recent high school graduates with hands-on experience in a research environment and encourage them to pursue careers in the science and engineering disciplines, particularly in those areas related to the needs of the Department of Defense. Students were selected on the basis of academic records,

scholastic aptitude test results, and applications. Students were assigned to a research project under the supervision of a research staff member at ARL:UT. At the end of the apprenticeship in mid-August, students gave oral presentations to the laboratory.